What is Claimed is:

Sub A1

1. A method for separating a nucleic acid of interest from a population of nucleic acid molecules, the method comprising;

providing a population of nucleic acid molecules;

contacting said population of nucleic acid molecules with a first targeting element, wherein said first targeting element binds specifically to at least one nucleic acid sequence of interest in said population of nucleic acid molecules;

attaching a separation group to said targeting element;

immobilizing said attached separation group to a substrate, thereby forming an immobilized targeting element-separation group complex ; and

removing said immobilized targeting element-separation group complex from said population of nucleic acid molecules, thereby separating said nucleic acid sequence of interest from said population of nucleic acid molecules.

2. The method of claim 1, wherein said at least one nucleic acid sequence of interest includes a distinguishing element.

Sub A2

3. The method of claim 2, wherein said targeting element binds to said at least one nucleic acid sequence of interest at a sequence within 20 nucleotides of said distinguishing element.

4. The method of claim 2, wherein said targeting element comprises a nucleic acid sequence.

5. The method of claim 4, wherein said targeting element is an oligonucleotide.

6. The method of claim 5, wherein said oligonucleotide has an extendable 3' hydroxy terminus.

7. The method of claim 6, wherein said separation group is an immobilizable nucleotide.

8. The method of claim 7, wherein said immobilizable nucleotide is a biotinylated nucleotide.

9. The method of claim 6, wherein said separation group is attached to said targeting element by extending said oligonucleotide with a polymerase in the presence of said biotinylated nucleotide, thereby forming an extended oligonucleotide primer containing said immobilizable nucleotide.

10. The method of claim 9, wherein said targeting element is an oligonucleotide.

11. The method of claim 10, wherein said separation group is an immobilizable nucleotide.

12. The method of claim 11, wherein said immobilizable nucleotide is a biotinylated nucleotide.

13. The method of claim 1, wherein said population of nucleic acids is a population of DNA molecules.

14. The method of claim 13, wherein said population of DNA moleucles is a population of genomic DNA moleucles or a population of cDNA molecules.

15 The method of claim 1, wherein said population of nucleic acid molecules is a population of RNA molecules.

16. The method of claim 2, wherein said distinguishing element is a single nucleotide polymorphism.

17. The method of claim 1, wherein said substrate is a particle, bead, magnetic bead, or glass surface, or plastic.

18. The method of claim 1, further comprising

contacting said population of nucleic acid molecules with a second targeting element, wherein said second targeting element binds specifically to at least one nucleic acid sequence of interest in said population of nucleic acid molecules,

attaching a second separation group to said second targeting element;

immobilizing said attached second separation group to a substrate, thereby forming a second immobilized targeting element-separation group complex , and

removing said immobilized targeting element-separation group complex from said population of nucleic acid molecules, thereby separating said nucleic acid sequence of interest from said population of nucleic acid molecules.

19. A method for separating a nucleic acid of interest from a population of nucleic acid molecules, the method comprising;

(a) providing a population of nucleic acid molecules;

(b) contacting said population of nucleic acid molecules with a targeting element attached to a separation group, wherein said targeting element binds specifically to at least one nucleic acid sequence of interest in said population of nucleic acid molecules;

(c) removing said separation group from said bound targeting element;

(d) immobilizing said attached separation group to a substrate, thereby forming an immobilized targeting element-separation group complex ; and

(e) removing said immobilized targeting element-separation group complex from nucleic acid of interest, thereby separating said nucleic acid sequence of interest from said population of nucleic acid molecules.

20. The method of claim 19, wherein said at least one nucleic acid sequence of interest includes a distinguishing element.